

Data Mining to analyze patterns of change

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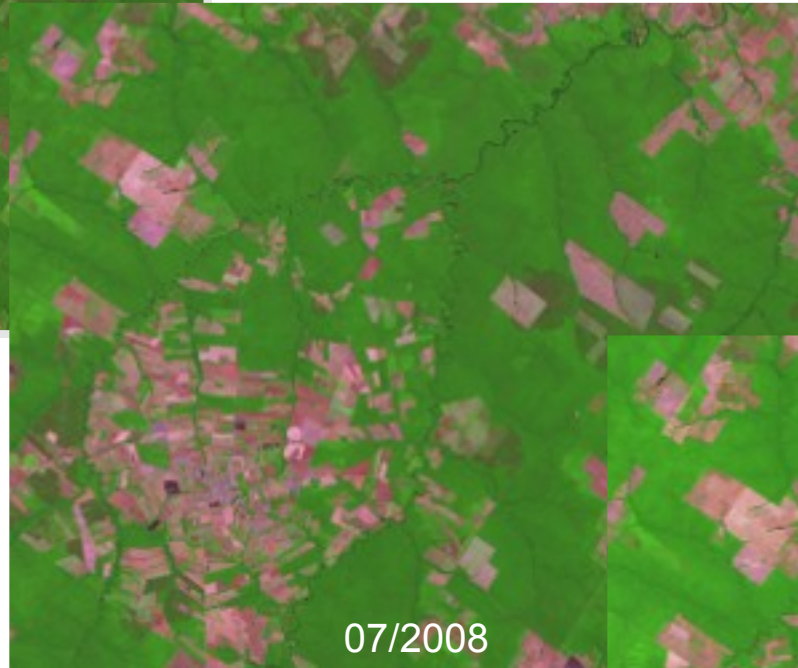
Science challenges for Land Change

- Understand patterns of change in local and global scale.
- What is the impact of human-induced land cover change?
- How are ocean, atmosphere and land processes coupled?
- Where are changes taking place?
- How much change is happening?
- Who is being impacted by the change?

The image depicts a complex satellite constellation orbiting the Earth. Numerous satellites, each with solar panels, are positioned along multiple intersecting orbital paths. The Earth is shown in the center, with its blue oceans and green landmasses visible. The background is a dark space filled with stars. A semi-transparent white box with rounded corners is overlaid on the lower half of the image, containing the text.

How to model
changing patterns in
land use / cover?

SITS – Satellite Image Time Series



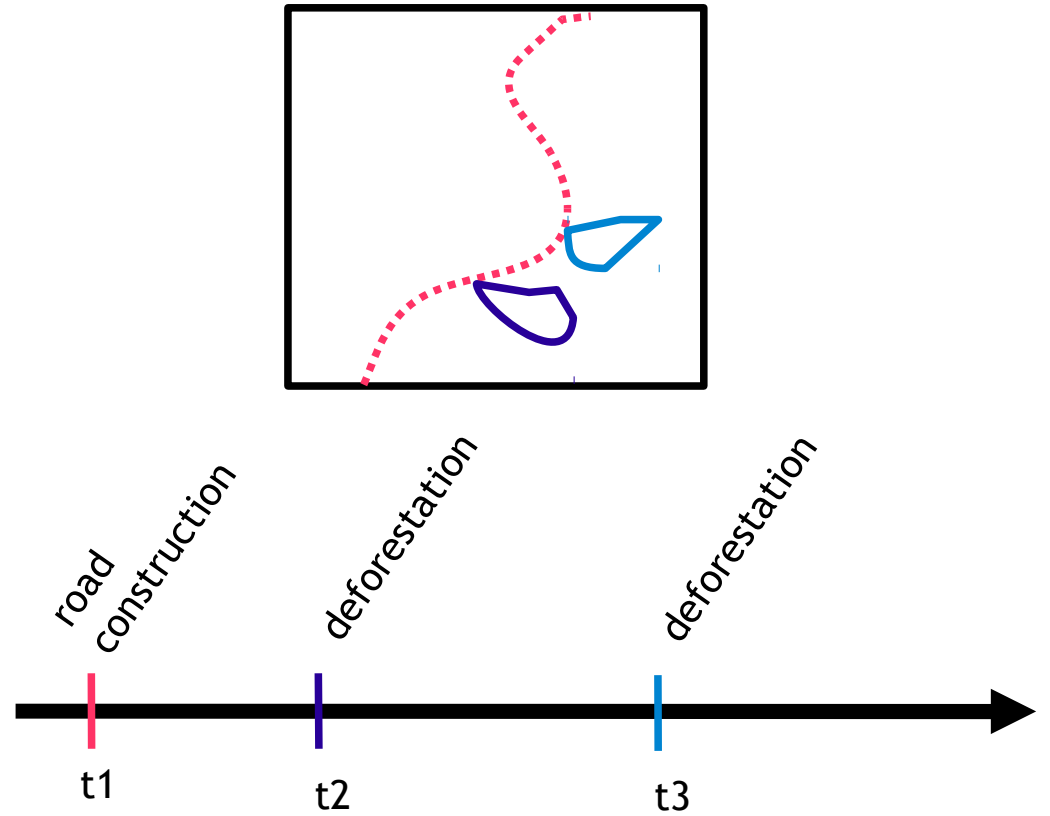
SITS



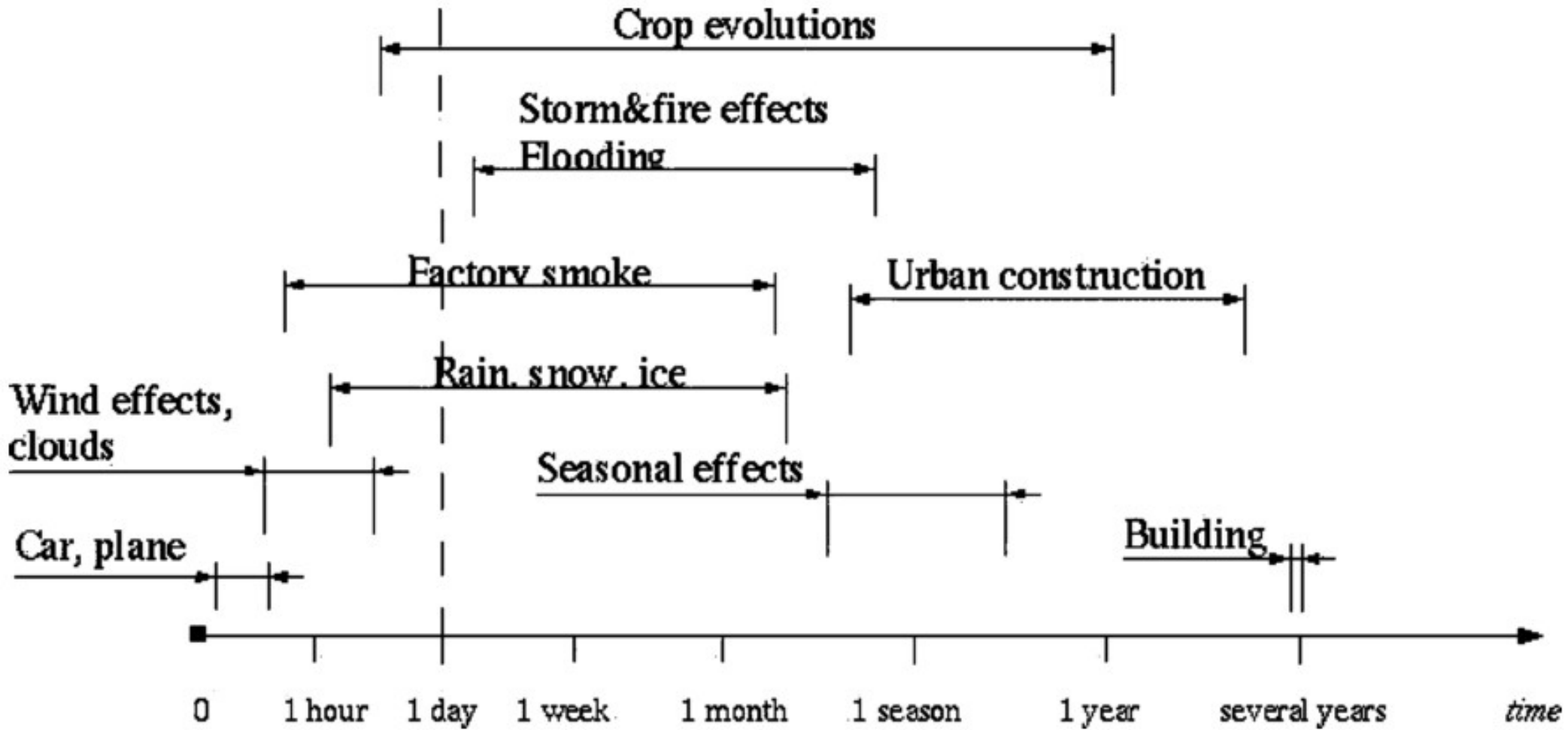
Detect
changes



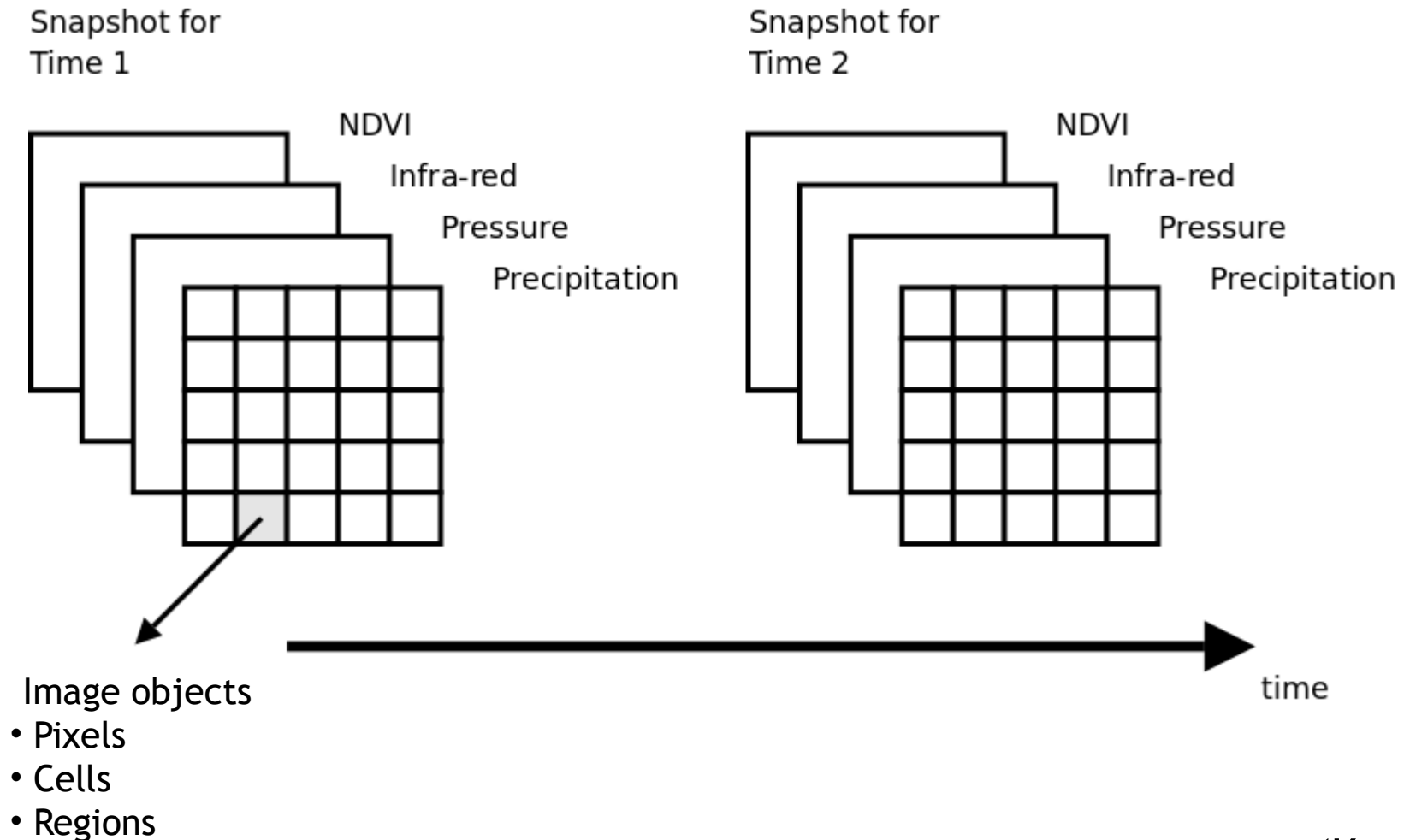
What?
When?
Where?



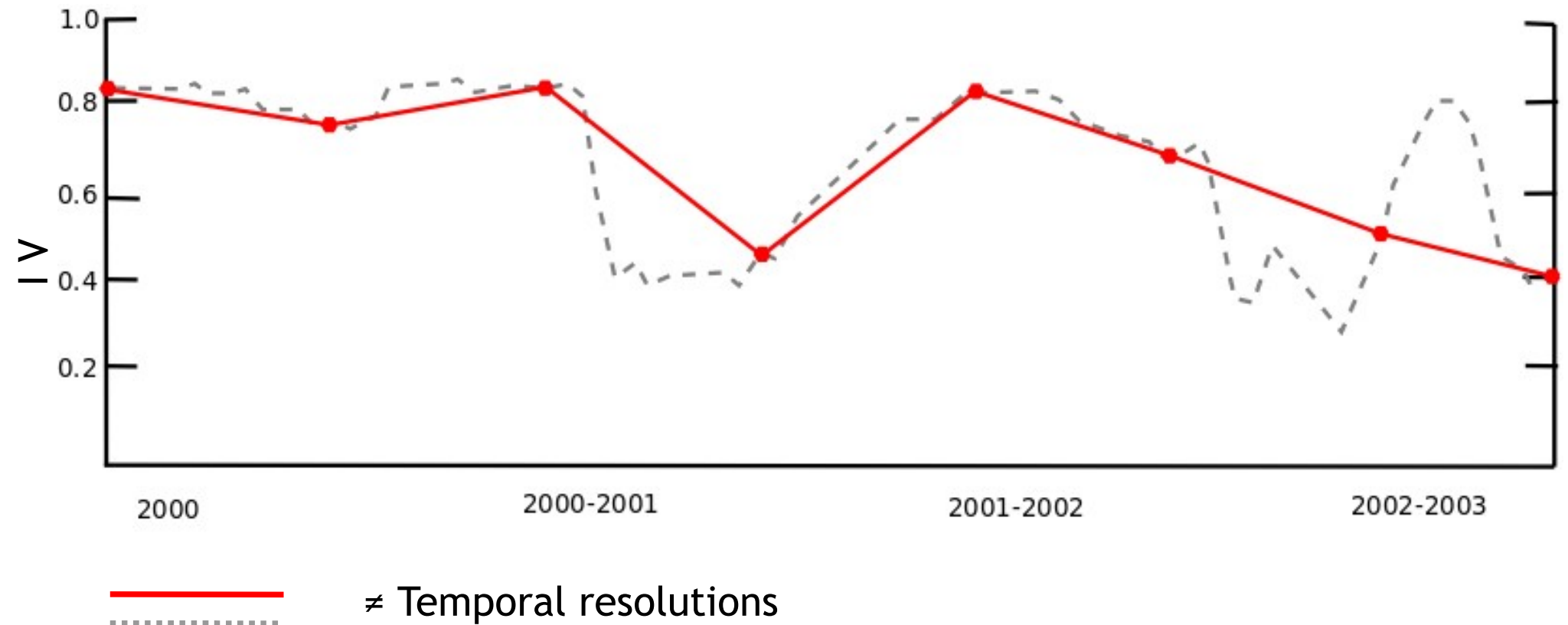
Land Changes



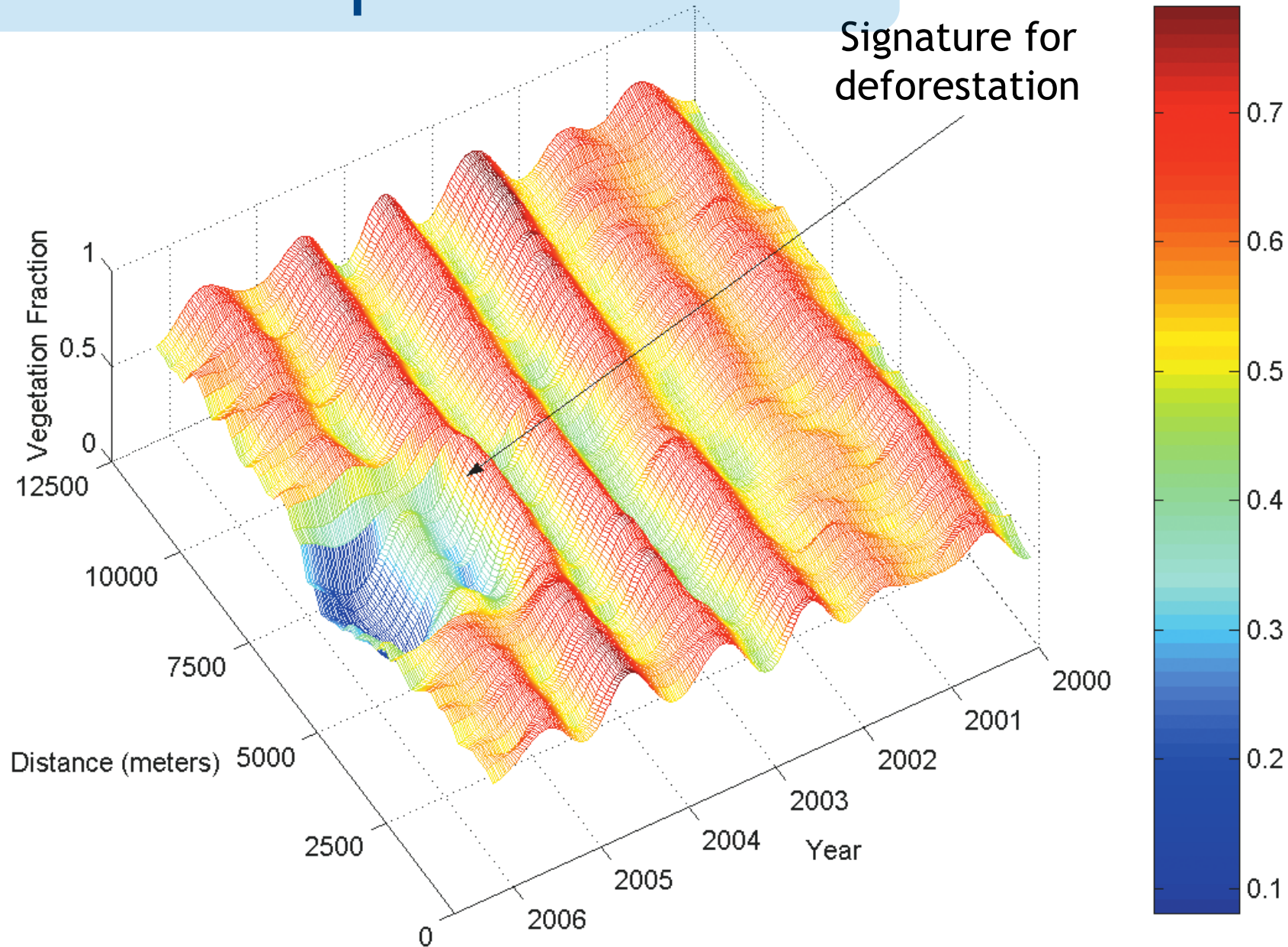
What attributes that best describe changing patterns?



Variations in image attributes define trajectories in time.

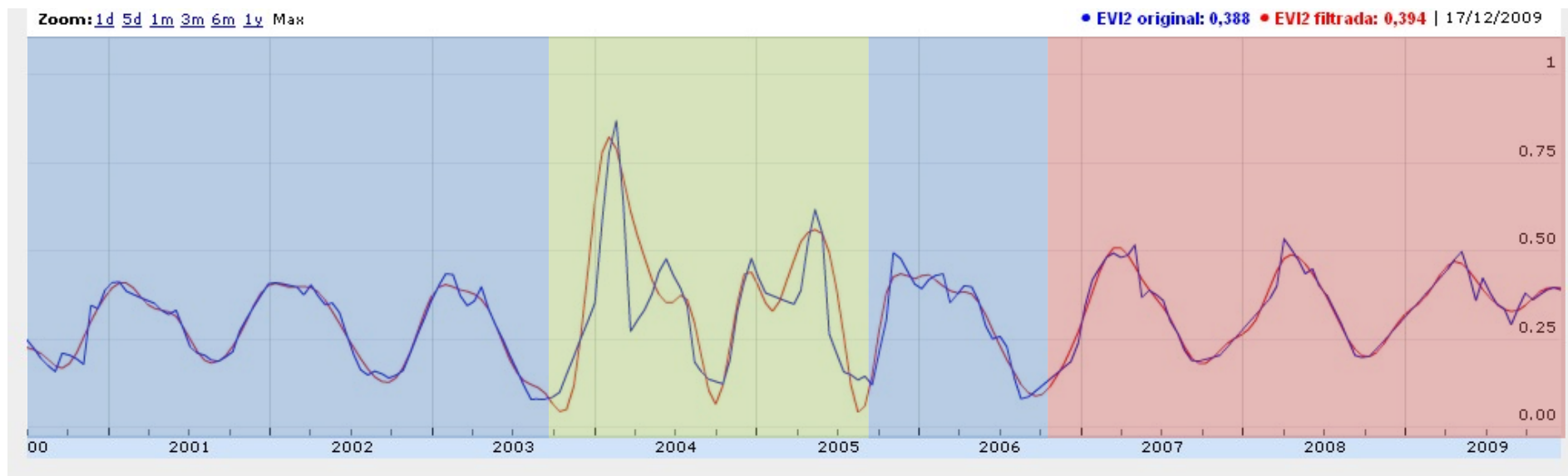


Similar trajectories define land use/cover patterns.



(Freitas, 2008)

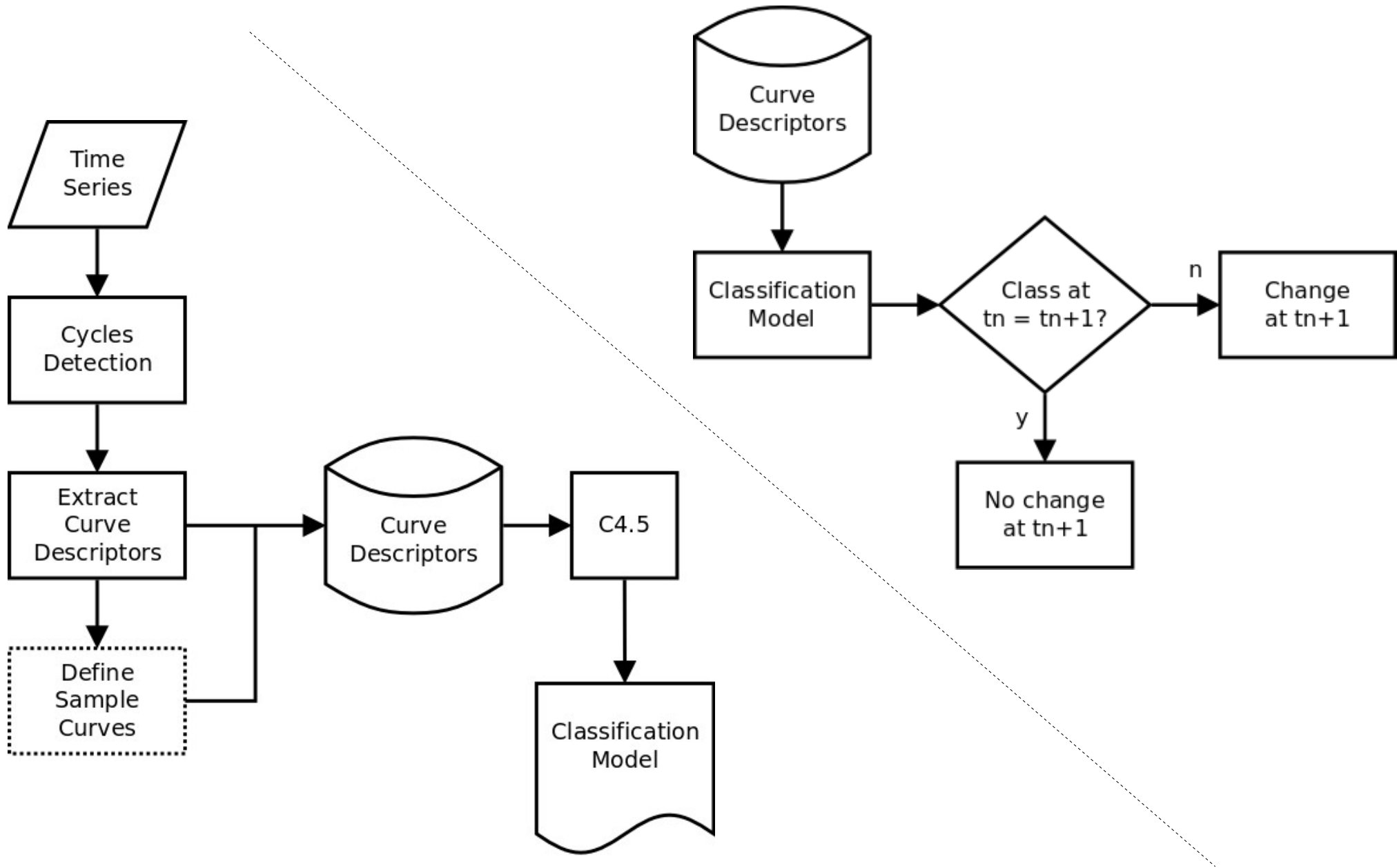
Recovering trajectories of change is useful to understand the land evolution.



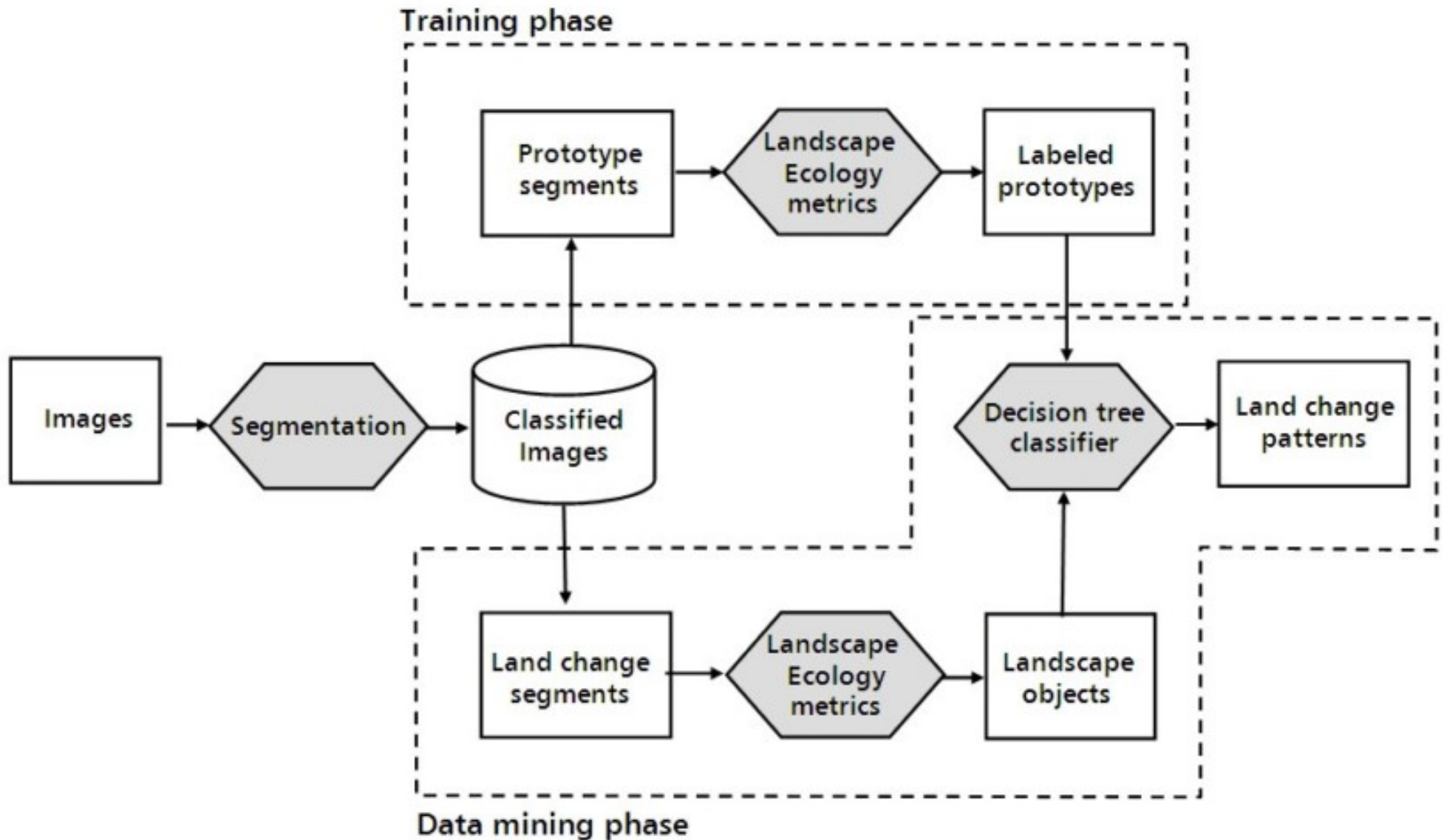
Objectives

- Use Data Mining to classify changing trajectories in remote sensing imagery.
- Develop tools for time series (and attributes) visualization.
- Suggest improvements to C4.5 algorithm of decision trees.

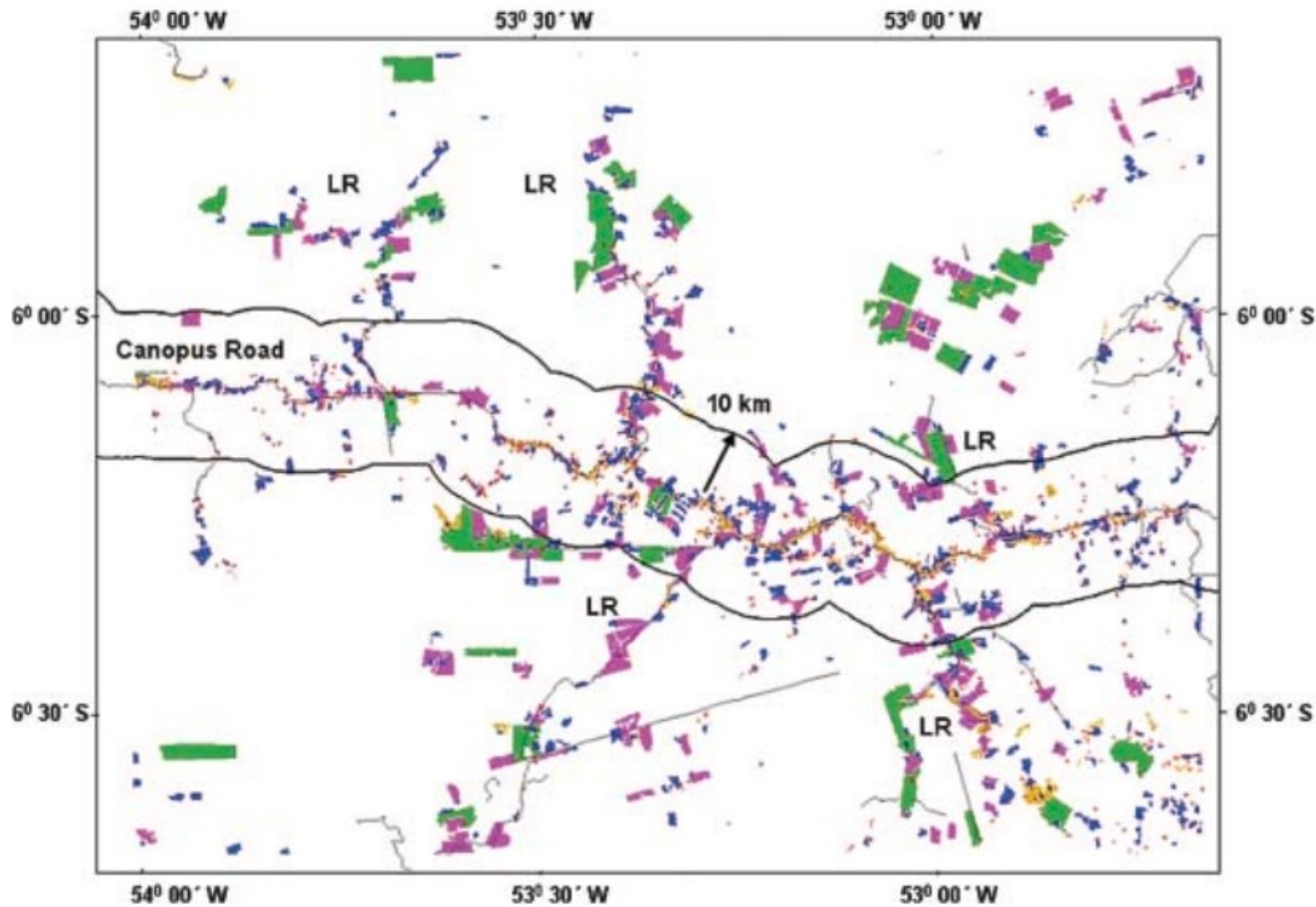
Data Mining to classify Land Changes



Timeline - PhD Marcelino Silva



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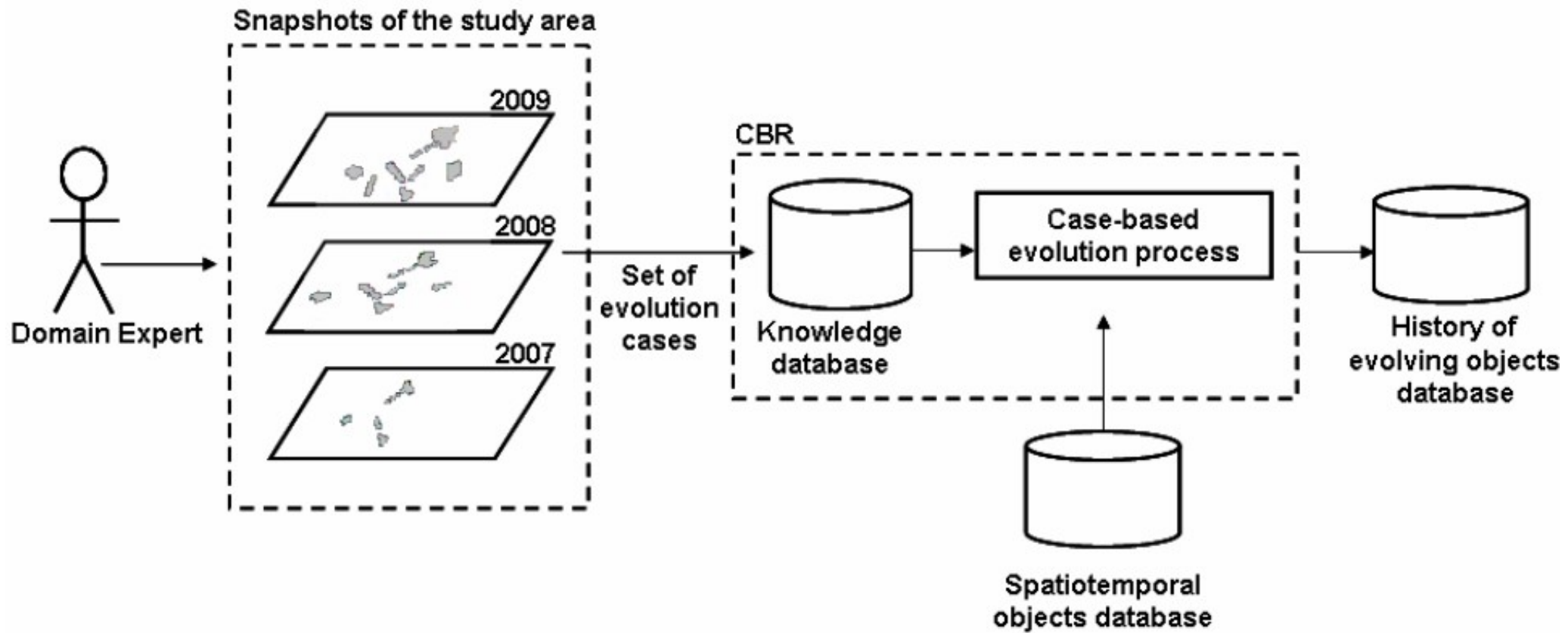
Clearing Patterns

- Irregular Isolated Small (SMA)
- Irregular Near-road Small (IRR)
- Irregular Near-road Medium (MED)
- Geometric Isolated (LAR)
- Linear (LIN)

LR - Local Roads

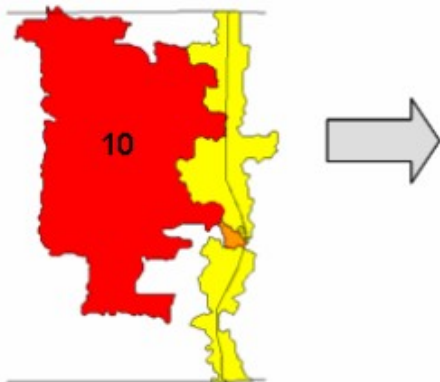


Timeline - PhD Joice Mota



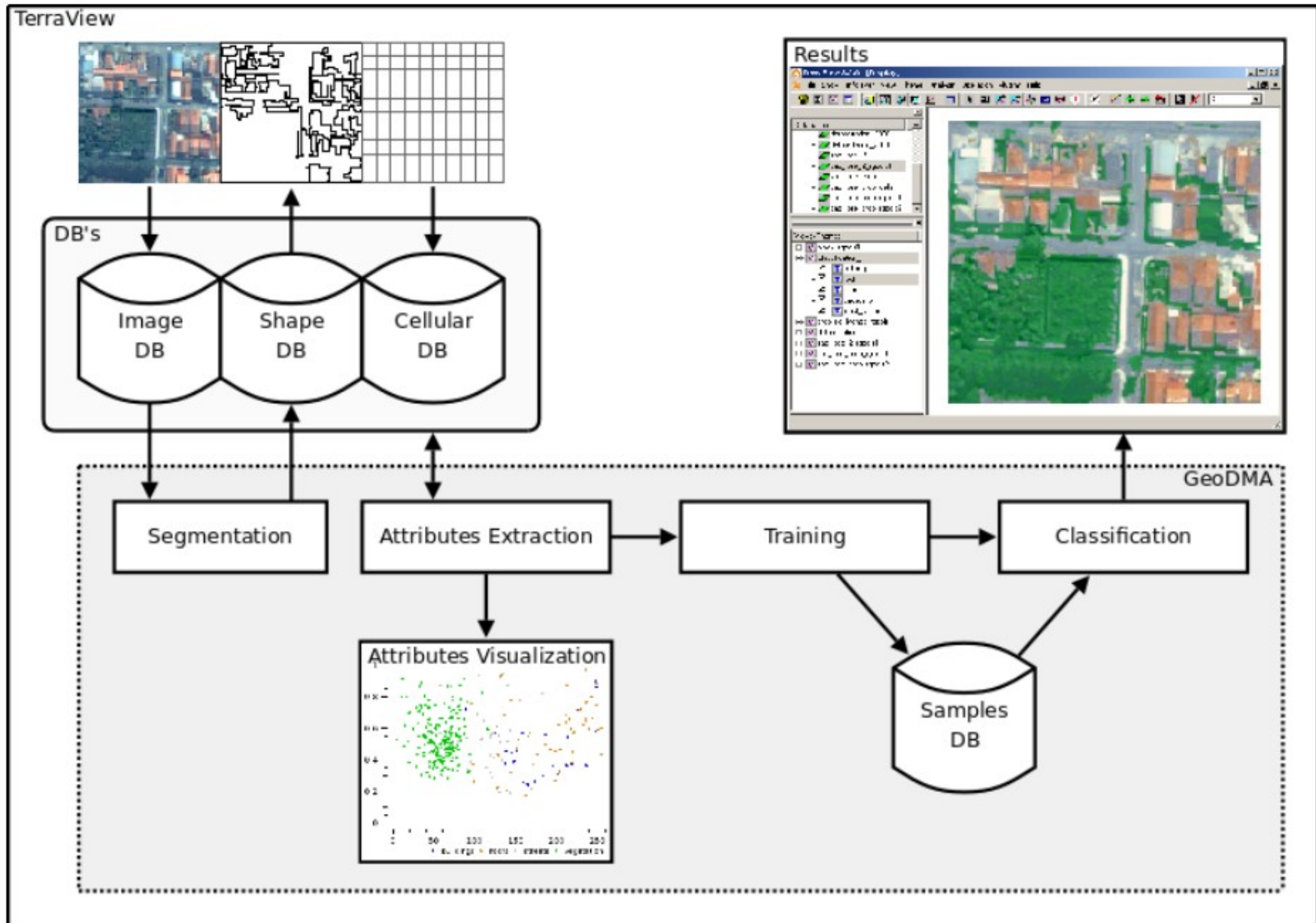
Timeline - PhD Joice Mota

Concentration in 1997



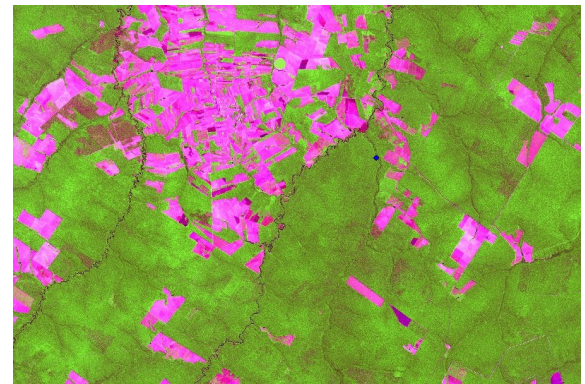
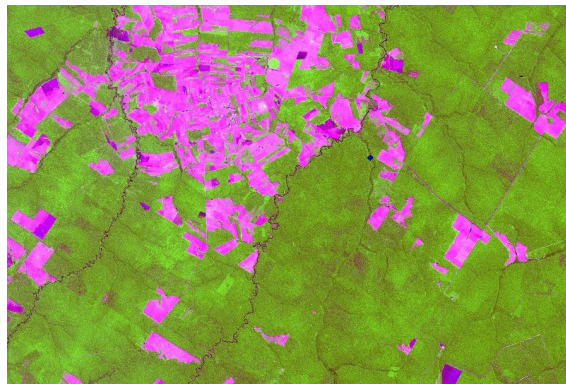
<i>Report Object's History</i>									
New Object	Father's Object 1	Type	Year	Father's Object 2	Type	Year	Result	New Area	Year
10	799	Concentration	1997	9	Small Lot	1997	Concentration	4858478,5447	1997
9	783	Concentration	1997	8	Small Lot	1997	Concentration	4751810,5137	1997
8	725	Concentration	1997	7	Small Lot	1994	Concentration	4722290,5137	1997
7	6	Concentration	1994	1	Small Lot	1991	Concentration	4715153,5137	1994
6	4	Concentration	1994	5	Concentration	1994	Concentration	4647959,5059	1994
5	3	Concentration	1994	355	Small Lot	1988	Concentration	1507617,0098	1994
4	507	Concentration	1994	2	Small Lot	1991	Concentration	3140342,4961	1994
3	486	Concentration	1994	43	Small Lot	1988	Concentration	3100958,4961	1994
2	497	Concentration	1991	42	Concentration	1988	Concentration	1475514,002	1991
1	478	Small Lot	1991	341	Small Lot	1988	Small Lot	67194,0078	1991

Timeline - GeoDMA



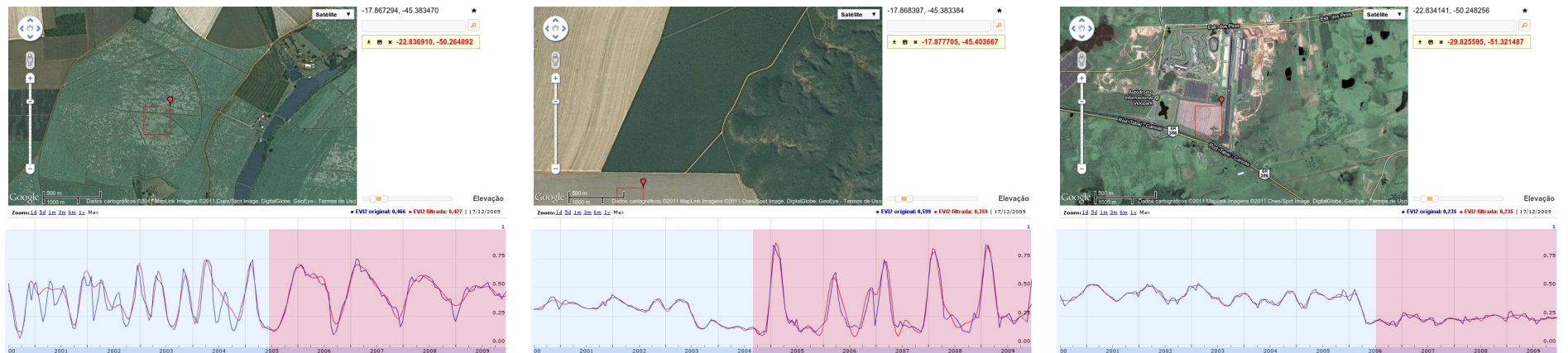
Application 1

- Automatic detection of deforestation using PRODES data as training reference.



Application 2

- Classification of land changes using LAF data.

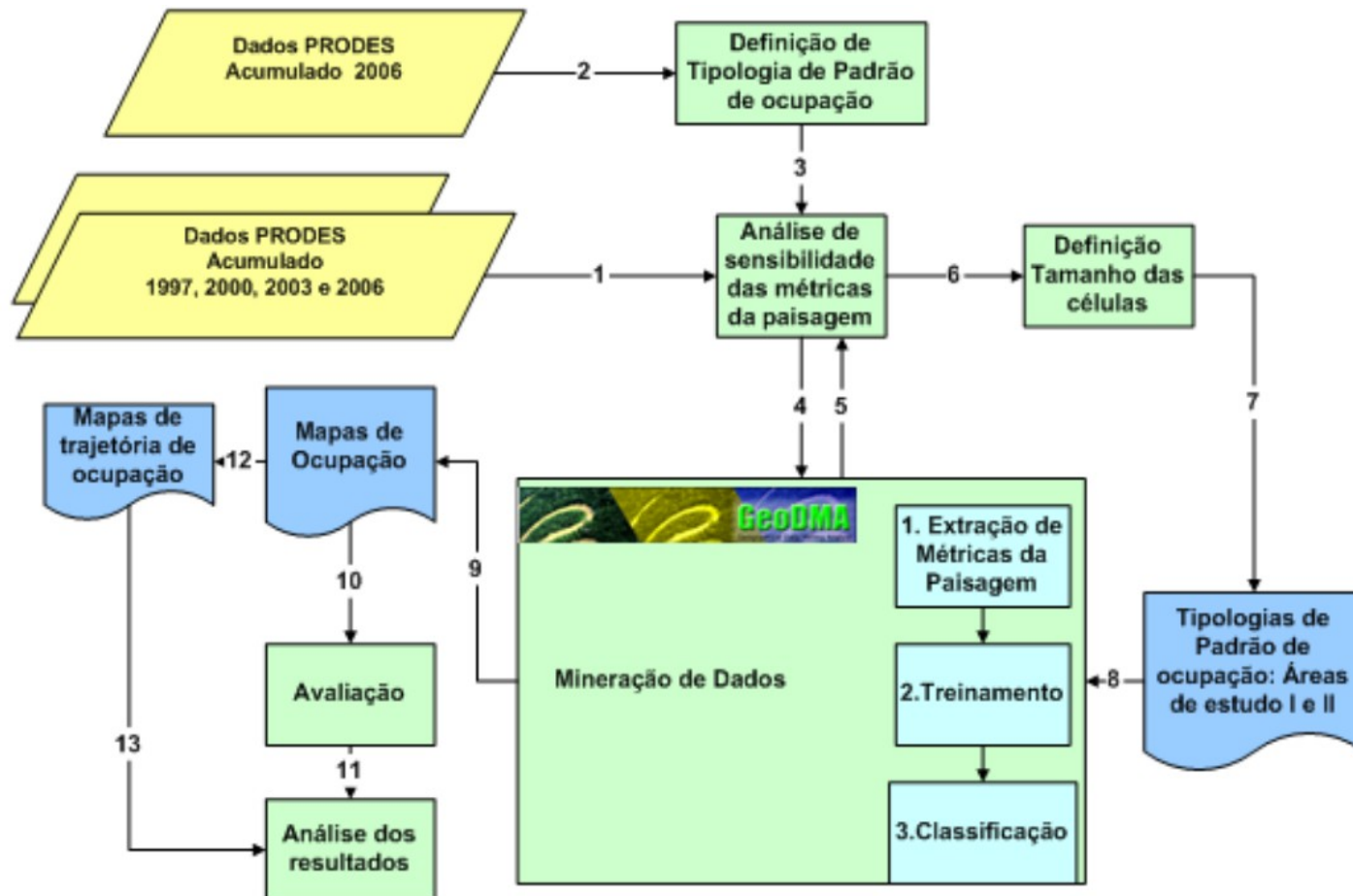


- Curve attributes

- Amplitude, Area, Maximum and Minimum Values, Mean, Median, (time series and 1st, 2nd slope)

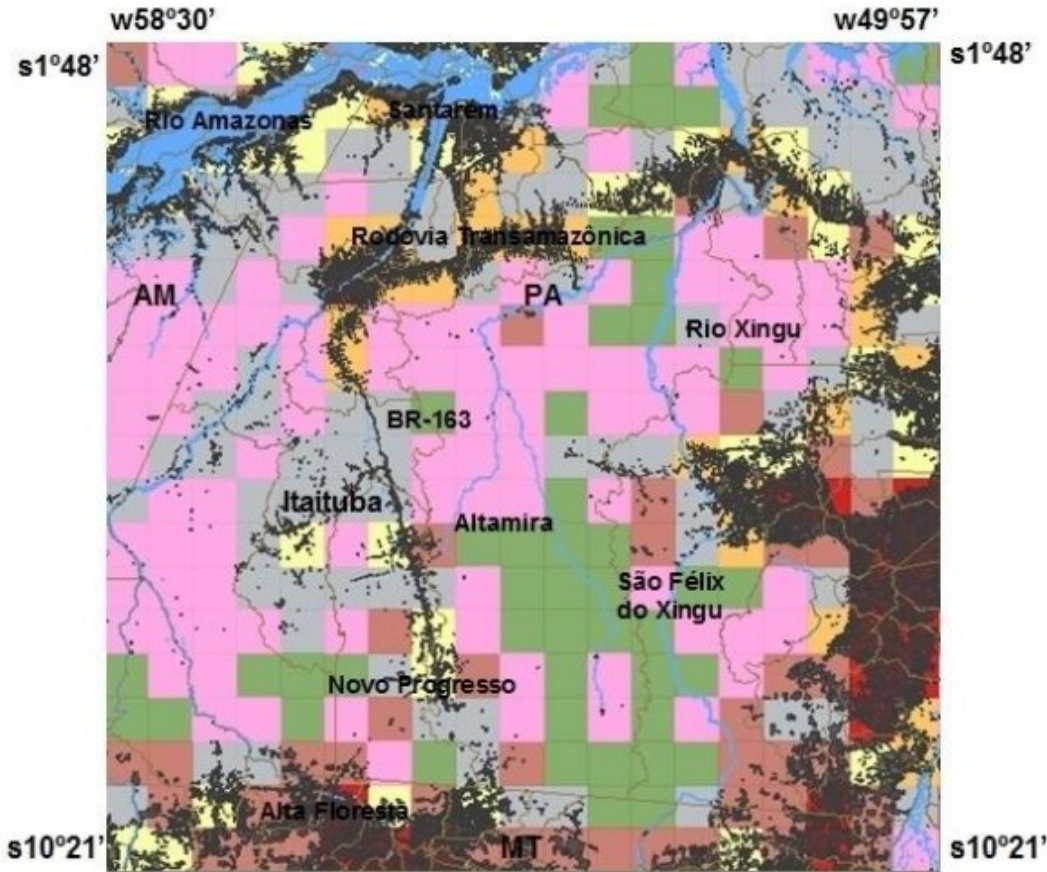
Application 3

- Classification of deforestation dynamics using Data Mining

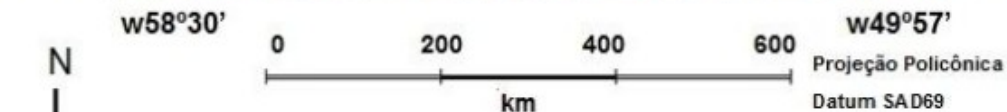
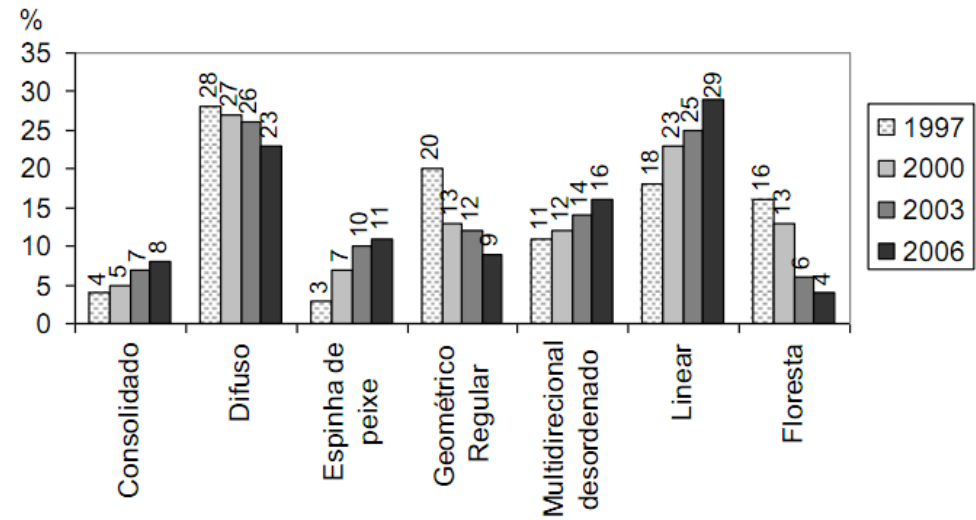


Application 3

Mapa de padrão de ocupação - 2000



Padrão de ocupação - área de estudo I



Legenda

- Padrão consolidado
- Padrão linear
- Padrão difuso
- Floresta
- Padrão espinha de peixe
- Desmatamento
- Padrão geométrico regular
- Hidrografia
- Padrão multidirecional desordenado
- Limite municipal

Publications

- EA Saito, MIS Escada, LMG Fonseca, TS Korting. Efeitos da mudança de escala em padrões de desmatamento na Amazônia. Revista Brasileira de Cartografia, 2011.
- EA Saito, MIS Escada, LMG Fonseca, TS Korting. Análise de padrões de desmatamento e trajetória de padrões de ocupação humana na Amazônia usando técnicas de mineração de dados. XV SBSR. Curitiba, Brazil. 2011.
- LY Sato, FSRV Martins, RZ Cantinho, TS Korting, LMG Fonseca, C Almeida, DM Valeriano. Classificação de áreas exploradas por sistema de corte seletivo na Amazônia. XV SBSR. Curitiba, Brazil. 2011.
- TS Korting, LMG Fonseca, G Camara. Interpreting images with GeoDMA. GEOBIA. Ghent, Belgium. 2010.
- TS Korting, LMG Fonseca, G Camara. Decision Trees to Detect Changes in Remote Sensing Image Time Series. GeoChange, GeoInfo. Campos do Jordão, Brazil. 2010.
- EA Saito, TS Korting, LMG Fonseca, MIS Escada. Mineração em Dados Espaciais de Desmatamento do Prodes Utilizando Métricas da Paisagem: Caso de Estudo Município de Novo Progresso - PA. III SIMGEO. Recife, Brazil. 2010.
- TS Korting, LMG Fonseca, MIS Escada, FC Silva, MPS Silva. GeoDMA - A novel system for spatial data mining. Data Mining Workshops, 2008. ICDMW '08. IEEE International Conference on. Pisa, Italy. 2008.
- FC Silva, TS Korting, LMG Fonseca, MIS Escada. Deforestation pattern characterization in the Brazilian Amazonia. SBSR - Brazilian Remote Sensing Symposium. Florianópolis, SC, Brazil. 2007.

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